

**REMARKS**

Favorable reconsideration is respectfully requested in view of the foregoing amendments and the following remarks.

**I. Claim Status & Amendments**

Claims 1-5 and 7-11 were pending in this application when last examined.

Claim 1 is amended to incorporate the subject matter of cancelled claim 4.

Claims 3-4, 7-8, and 10-11 are cancelled without prejudice.

Claims 1, 2, 5 and 9 remain in this application.

No new matter has been added by the above claim amendments.

**II. Claim Objections**

Claim 8 was objected to as being of improper dependent form for failing to further limit the subject matter of a previous claim for the reasons on page 3 of the Office Action.

The objection is moot as claim 8 is now cancelled herein, thus withdrawal of the objection is solicited.

### III. Prior Art Rejections

Claims 1-3, 7, 9 and 10 were rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Mehrotra et al., 24 J. ORGANOMET. CHEM., 611-21 (1970) for the reasons on pages 3-4 of the Office Action.

By the present amendment the M substituent of the formula depicted in claim 1 is specified to be hafnium, as in the previous claim 4.

The compound of Mehrotra includes a silicon atom, and thus Mehrotra was not applied against previous claim 4.

Therefore, claim 1 as amended herewith and all claims dependent thereon are believed to be novel over Mehrotra, and withdrawal of the anticipation rejection is respectfully requested.

Claims 4, 8, and 11 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Lim et al. 10 SURF. REV. LETT., 685-89 (2003) for the reasons on pages 5-6 of the Office Action. That rejection is respectfully traversed, for the following reasons.

Although claims 4, 8, and 11 are now cancelled, as noted above claim 1 has been amended to incorporate the subject matter of cancelled claim 4, and so the obviousness rejection will be addressed in the context of the amended claim 1.

Although the Office Action acknowledges that Lim differs from the claimed invention at least in that Lim discloses compounds that include straight chain alkyl linkages between the oxygen and nitrogen atoms of the ligands rather than branched chain alkanediyl, the Office Action nevertheless asserts that one skilled in the art would have regarded  $\text{Hf}(\text{OCH}_2\text{CH}_2\text{N}(\text{CH}_3)_2)_4$  and  $\text{Hf}(\text{OCH}(\text{CH}_3)\text{CH}_2\text{N}(\text{CH}_3)_2)_4$  to be homologues of one another and further would have expected the corresponding compounds to have similar reactivities and physical properties.

However, the disclosure of Lim does not render present claim 1 *prima facie* obvious; moreover, even if claim 1 were to be considered as *prima facie* obvious over Lim, the present specification and the accompanying Rule 132 Declaration provide clear evidence of unexpected results effective to overcome any *prima facie* case of obviousness.

As to *prima facie* obviousness, the mere characterization of a claimed compound and a prior art compound as being "homologous" does not establish a *prima facie* case of obviousness, because the structure of the claimed compound must of course be suggested to the skilled artisan in the first instance, before he could form any expectation as to its properties relative to those of a prior art compound. That is why, in the context of obviousness rejections in the chemical arts relying upon only a single

reference, the concept of structural homology is narrowly construed to mean adjacent members of a homologous series. See, for example, *In re Henze*, 181 F.2d 196 (CCPA 1950).

Thus, with reference to the compound  $\text{Hf}(\text{OCH}_2\text{CH}_2\text{N}(\text{CH}_3)_2)_4$  of Lim, an adjacent homologue might be  $\text{Hf}(\text{OCH}_2\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)_2)_4$ , but the internally branched ligands of the claimed compounds are not adjacent homologues of the internally straight-chain ligands of the Lim compound.

As such, the compound of Lim does not render *prima facie* obvious the compounds of present claim 1.

Furthermore, the data in the present specification and the accompanying Rule 132 Declaration make a strong showing of unexpected results in connection with the claimed compounds.

In the Evaluation Example 4 at pp. 28-29 of the present specification, it is confirmed that compound No. 13  $[\text{Hf}(\text{OC}(\text{CH}_3)_2\text{CH}_2\text{N}(\text{CH}_3)_2)_4]$  according to the present invention, which has a branched chain alkanediyl moiety, has a sufficiently high vapor pressure to function as a CVD material. In contrast, comparative compound 4 in the Evaluation Example 4 of the present specification, which corresponds to  $\text{Hf}(\text{OCH}_2\text{CH}_2\text{N}(\text{CH}_3)_2)_4$  taught in Lim et al., failed to obtain a vapor phase.

The accompanying Rule 132 Declaration provides results of TG-DTA analysis (thermal gravimetric and differential thermal analysis) on the following compounds:

Hf(OCH<sub>2</sub>CH<sub>2</sub>N(CH<sub>3</sub>)<sub>2</sub>)<sub>4</sub> : Comparative compound 4 of the present specification (corresponding to the compound taught in Lim et al.)

Hf(OCH(CH<sub>3</sub>)CH<sub>2</sub>N(CH<sub>3</sub>)<sub>2</sub>)<sub>4</sub> : Compound No. 12 of the present specification

Hf(OC(CH<sub>3</sub>)<sub>2</sub>CH<sub>2</sub>N(CH<sub>3</sub>)<sub>2</sub>)<sub>4</sub> : Compound No. 13 of the present specification

As evident from the results of TG-DTA analysis, both the Compounds Nos. 12 and 13 vaporized at around 270°C, hardly leaving residues. By contrast, even heated to 330°C or higher, almost 40% of comparative compound 4 remains as residue. That is consistent with the disclosure in Evaluation Example 4 of the present specification. As comparative compound 4 decomposes only gradually by heat, leaving residue, it is not suitable as a CVD material for thin film formation, which is the objective of the claimed invention.

Since the claimed compounds containing a branched chain alkanediyl moiety display unexpectedly superior properties relative to the Hf(OCH<sub>2</sub>CH<sub>2</sub>N(CH<sub>3</sub>)<sub>2</sub>)<sub>4</sub> compound of Lim, the present claims are non-obvious over Lim, and withdrawal of the obviousness rejection is respectfully requested.

#### IV. Conclusion

In view of the present amendment and the foregoing remarks, it is respectfully submitted that the present application is in condition for allowance and an early notice to that effect is hereby requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

/Andrew J. Patch/  
Andrew J. Patch, Reg. No. 32,925  
209 Madison Street, Suite 500  
Alexandria, VA 22314  
Telephone (703) 521-2297  
Telefax (703) 685-0573  
(703) 979-4709

AJP/ml

**APPENDIX:**

The Appendix includes the following item:

☒ - a 37 CFR 1.132 Declaration